edition furnishes distressing mistranslations. When the French idiom *ne . . . . que* is translated as a flat negative, the author is made to say the exact reverse of what he means, and the rest of the paragraph becomes absurd. The French use of the article has been carried over literally, even where it fits the English idiom! Again, where the author says, for example, a fluid *may reach* a certain concentration, the faithful translator puts it, *is able to reach*. "Matières hydrocarbonnes" becomes "hydrocarbon materials," in heavy-faced type; and the paragraph discusses sugar, cellulose, and glycogen! Perhaps the consistent reference to WAGER as WAGNER in the text is an error of proofreading, for the name is correct in the bibliography and in the French text. The American book is very well printed, with large, open, legible type, but no one can safely use it without having a copy of the original at hand, or at least without having enough knowledge of French to read the original author's meaning between the lines.—H. S. CONARD.

NOTES FOR STUDENTS

Electrons in photosynthesis.—An attempt has been made by DIXON and POOLE[3] to interpret photosynthesis in terms of the electronic theory. On the basis of photo-electric phenomena in sensitizers of photographic films, and the absorption spectra of chlorophyll, they believe that the first action of light is to disturb electrons in the chlorophyll molecule. Experiments were made to determine whether the electrons were actually ejected by the incident radiation, or whether the disturbances were too weak to do more than displace the electrons within groups of atoms, or from molecule to molecule of chlorophyll.

By delicate electrometer measurements they were able to establish the occurrence of a slight photo-electric effect in chlorophyll under illumination, but this effect is apparently produced by ultra violet radiations, not by those of visible frequencies and synthetic activity, for they find that the effect is magnified about 2000 times by use of a light rich in ultra violet rays. Quantitative use of the data showed that possibly 75 electrons per square centimeter per second might be ejected from a layer of chlorophyll by light from a 500 watt lamp. In terms of energy, this effect is utterly negligible, for the actual synthesis of food in plants goes on at a rate which would require about nine trillion times as much energy as these ejected electrons could supply. It is necessary to conclude, therefore, that ejection of electrons is not significant in photosynthesis, and that the chlorophyll cannot ionize substances external to itself by electronic bombardment. If this be true, then the synthetic reactions must concern the chlorophyll molecule itself, and the electrons are merely shifted from atom to atom, or molecule to molecule, as in ordinary chemical reactions. These shiftings, of course, will alter linkages, and change the chemical character of atomic groups, probably rendering inactive groups of atoms reactive. Such

[3] DIXON, HENRY H., and POOLE, HORACE H., Photosynthesis and the electronic theory. Sci. Proc. Roy. Dublin Soc. **16**:63–77. 1920.

a conception favors the chemical theories of photosynthesis which assume that chlorophyll itself enters into the reactions, rather than those which assume that the synthetic reactions are performed externally to the chlorophyll by means of energy absorbed and transformed by the pigments.

That the light actually displaces electrons seems to be proved by DIXON and BALL[4], who show that the chlorophyll acts as a sensitizer of photographic films at the temperature of liquid air, a temperature believed to be too low for chemical reactions other than electronic displacement. They suggest that chlorophyll α and β might have an important connection in the synthetic process, as indicated by the following equations:

$$\underset{\text{(chlorophyll }\alpha)}{C_{55}H_{72}O_5N_4Mg}+CO_2 \rightarrow \underset{\text{(chlorophyll }\beta)}{C_{55}H_{70}O_6N_4Mg}+HCHO$$

$$\underset{\text{(chlorophyll }\beta)}{C_{55}H_{70}O_6N_4Mg}+H_2O \rightarrow \underset{\text{(chlorophyll }\alpha)}{C_{55}H_{72}O_5N_4Mg}+O_2$$

The fact that *in vitro* experiments with chlorophyll α and CO_2 do not yield formaldehyde could be explained by accepting WILLSTÄTTER'S assumption that before the CO_2 will react with the chlorophyll it must first be combined into a carbamino acid, which can then be decomposed by the reactive group in the chlorophyll, which group was rendered reactive by the electronic shifting due to light.

Regardless of whether the discovered facts are sufficient to establish the relations between electronic displacements and synthesis of carbohydrates, the attempt made by the authors to carry over into physiological interpretations the newer conceptions of electron chemistry is praiseworthy, and will be followed with great interest by physiologists. Ultimately all the chemical processes of life must be interpreted along similar lines.—C. A. SHULL.

The mycoplasm theory.—In two brief notes in English and an extended discussion in German, ERIKSSON[5] makes a spirited defense of his mycoplasm theory. Only incidental reference is made in these papers to the work on the grain rust, on which the theory was established, but the previously published conclusions on the downy mildew of spinach, the late blight of potato, and the hollyhock rust are reaffirmed, critics are replied to, not without acerbity, and in the case of the hollyhock rust new observations and experiments are adduced which, the author believes, still further support his hypothesis, of which he is not only the originator, but has been, to date, almost the sole protagonist. In

[4] DIXON, HENRY H., and BALL, NIGEL G., Photosynthesis and the electronic theory. II. Notes Bot. School, Trinity Coll., Dublin **3**:199–205. 1922.

[5] ERIKSSON, JAKOB, The mycoplasm theory, is it dispensable or not? Phytopath. **11**:385–388. 1921.

———, The life of *Puccinia malvacearum* Mont. within the host plant and on its surface. Phytopath. **11**:459–463. 1921.

———, Das Leben des Malvenrostpilzes (*Puccinia malvacearum* Mont.) in und auf der Nährpflanze. Handl. Kungl. Svensk. Vetensk.-Akad. **62**[5]:1–190. *figs. 31*. 1921.